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Fiber-Optic Devices as Temperature Sensors for Temperature Measurements in AC Magnetic Fields

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We report on the investigation of several fiber-optic devices as potential sensors for temperature measurements in AC magnetic fields. Common temperature sensors, such as thermocouples, thermistors or diodes, will create random and/or systematic errors when placed in a magnetic field. A DC magnetic field is susceptible to create a systematic offset to the measurement, while in an AC magnetic field of variable frequency random errors which cannot be corrected for can also be introduced. Fiber-Bragg-gratings and thin film filters have an inherent temperature dependence. Detrimental for their primary applications, the same dependence allows one to use such devices as temperature sensors. In an AC magnetic field, they present the advantage of being immune to electromagnetic interference. Moreover, for fiber-Bragg-gratings, the shape factor and small mass of the bare-fiber device make it convenient for temperature measurements on small samples. We studied several thin-film filters and fiber-Bragg-gratings and compared their temperature measurement capabilities in AC magnetic fields of 0 to 150 Gauss, 0 to 20 KHz to the results provided by off-the-shelf thermocouples and thermistor-based temperature measurement systems.

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